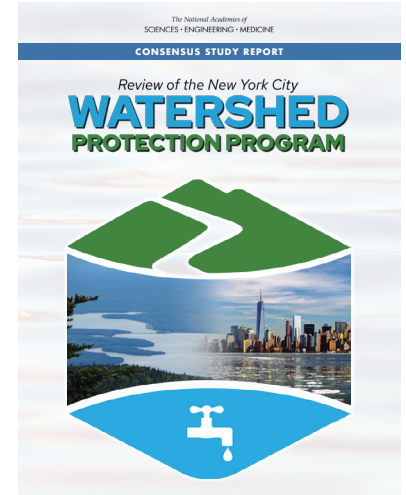




November 2020

Review of the New York City Watershed Protection Program

New York City's water supply is fed by two forested watersheds north of the City. A multifaceted Watershed Protection Program has enabled city water managers to meet water quality standards without having to build a costly water filtration plant for the larger Catskill/Delaware supply; only disinfection and occasional treatment of high turbidity caused by storms is needed. This report assesses the efficacy and future of NYC's extensive watershed management activities. The Watershed Protection Program overall appears to have admirably supported watershed water quality sufficient for compliance with the Surface Water Treatment Rule, with strong indications that it will remain effective into the future.



For almost 180 years, New York City (NYC) has shown a great deal of foresight to supply safe drinking water to its large population. Today's municipal supply comes from the nearby Croton watershed (which began operations in 1842) and the larger and more distant Catskill/Delaware watershed, put into service during the early 20th century (see Figure 1). The current system provides about 1 billion gallons of drinking water a day to over 8.5 million people in NYC and about 1 million people living in nearby Westchester, Putnam, Ulster, and Orange counties.

The combined Catskill/Delaware portion of the water supply is the largest unfiltered water supply in the United States, with chlorine and ultraviolet disinfection being the primary means of treatment. The Watershed Protection Program has allowed the New York City Department of Environmental Protection (NYC DEP), which runs the water supply system, to secure a series of waivers from the filtration requirements of the U.S. Environmental Protection Agency's Surface Water Treatment Rule.

The Watershed Protection Program has a variety of technical elements to control potential sources of pollution to the water supply, such as wastewater and stormwater, streambank erosion, and agricultural and forest management activities. This study reviews

and evaluates the NYC DEP's Watershed Protection Program—with the goal of determining whether the current suite of individual programs is appropriate and adequate to comply with the Surface Water Treatment Rule now and into the future.

EVALUATION OF THE WATERSHED PROTECTION PROGRAM

Since 1997, \$2.5 billion have been spent on various subprograms of the Watershed Protection Program, averaging \$100 million annually. All of the subprograms derive from a 1997 Memorandum of Agreement (MOA) and subsequent filtration avoidance determinations that outline the suite of actions that NYC DEP must take to comply with the Surface Water Treatment Rule. The MOA has two overarching goals: protecting the water quality in the reservoirs and ultimately in NYC drinking water and enhancing the vitality of communities in the upstream watersheds. This report provides the following conclusions and recommendations about each subprogram.

WATERSHED AGRICULTURAL PROGRAM

The Watershed Agricultural Program works with farm and forest landowners in the Croton and



FIGURE 1 New York City's surface water supply system. The combined water supply system includes 19 reservoirs and three controlled lakes with a total storage capacity of approximately 580 billion gallons. Approximately 10 percent of NYC's average daily water demand is supplied by the Croton system, which is now filtered, with the Catskill/Delaware system supplying the remaining 90 percent.

STREAM MANAGEMENT PROGRAM

Established in the mid-1990s and now one of the largest subprograms, the Stream Management Program aims to reduce suspended sediment transport that leads to high turbidity in west-of-Hudson streams and reservoirs. In addition to minimizing erosion and sediment transport that can lower water quality, the projects of the Stream Management Program benefit watershed communities by providing flood hazard mitigation; protection of roads, bridges, and other public infrastructure; protection of private property; and improvement of aquatic habitat.

- The Stream Management Program stands out among stream restoration efforts nationwide in that its approach focuses on whole watersheds, and substantial attention is given to scientific investigation, stream corridor mapping, and long-term water quality monitoring.
- The Stream Management Program, in collaboration with others, should move into vigorous data analysis even as new data are collected.

LAND ACQUISITION PROGRAM

The Land Acquisition Program, through which NYC DEP purchases land in the Catskill/Delaware watershed from willing sellers, has been critical in complying with the Surface Water Treatment Rule. Land acquisition is meant to prevent activities or development that may harm water quality, generally keeping lands in an undeveloped state or redirecting development to less-sensitive lands. The program's large budget and the necessary interactions between NYC DEP and stakeholders have created tension regarding local communities' objectives for continued economic vitality.

- The metrics of the Land Acquisition Program should focus on acquisition of the most valuable lands for water quality protection, not on the number of acres solicited.

Catskill/Delaware watersheds. The program's goals are to protect water quality (focusing on nutrients, microbial pathogens, sediment, and pesticides) and to ensure the economic vitality of watershed agriculture. Farms voluntarily enrolled in the program must have Whole Farms Plans that specify the best management practices that will be implemented on an individual farm to prevent pollutants (e.g., animal waste) from entering nearby waterbodies. The Watershed Agricultural Program has had great success in enrolling a high percentage of farms.

- The Committee's original analysis of soil phosphorus data collected from agricultural lands in the Cannonsville watershed shows that concentrations have fallen slowly over the last decade.
- To combat phosphorus mass balance problems, the Watershed Agricultural Council should develop a public-private partnership to turn manure into energy and/or other useful byproducts.
- The Watershed Agricultural Council and the New York City DEP should jointly develop a climate action plan for agriculture.

- The NYC DEP should work with watershed communities to identify parcels now owned by NYC DEP with lower protection value that offer development or relocation potential. These parcels could be sold or swapped for higher-protection-value lands, serving both watershed protection and community vitality objectives.
- The NYC DEP should shift funding and emphasis to the Flood Buy-Out and Streamside Acquisition programs, which aim to acquire riparian lands on critical areas of tributary streams.

WASTEWATER PROGRAMS

Wastewater treatment in the Croton, Catskill, and Delaware watersheds with centralized wastewater treatment plants or septic systems has a direct impact on water quality in the watersheds and ultimately on NYC's drinking water. All 42 wastewater treatment plants in the west-of-Hudson region have been upgraded to state-of-the-art, tertiary-equivalent treatment, including seven new wastewater treatment plants constructed as part of the New Sewage Treatment Infrastructure Program. The phosphorus loadings from these sources to streams in the watershed have declined by more than 90 percent since the upgrades were installed, and suspended solids and pathogens loads have also declined. Nonetheless, 80 percent of the population in the Catskill/Delaware watershed relies on septic systems.

- Protecting the Kensico Reservoir from wastewater treatment plant effluent and failed septic systems should be a top priority for the Watershed Protection Program.
- The Septic System Program should be better funded to accelerate its implementation, eliminate the backlog of septic system repairs and replacements, and train contractors on the installation and maintenance of best available control technologies.
- The NYC DEP is encouraged to require the use of aerobic treatment units for new and replacement septic tanks. Further, given the topography and soil characteristics of the Catskill region, alternative soil adsorption systems (shallow adsorption, mound, or drip systems) should be required to ensure more complete wastewater treatment.

ECOSYSTEM PROTECTION AND MANAGEMENT PROGRAMS

The report reviews three forest conservation programs in the west-of-Hudson watershed, as well as the Wetlands Program, the terrestrial and aquatic Invasive Species Program, and the Aquatic Ecology Program. Protecting terrestrial and aquatic ecosystems is central to maintaining NYC DEP's filtration avoidance status and supplying high-quality water to its consumers.

- The Watershed Forestry Program should grow to increase the proportion of private forestland that it influences.
- A working group of Watershed Agricultural Council and their partners could evaluate prospects for small- and intermediate-scale wood chip gasification in the Catskills.
- The NYC DEP should clarify the terrestrial and aquatic invasive species programs' responsibilities within the regional invasive species collaborative network and support these responsibilities adequately.

PUBLIC HEALTH PROGRAMS

Several subprograms of the Watershed Protection Program focus on threats to NYC's drinking water from waterborne microbial pathogens. To maintain its filtration avoidance determination, the NYC DEP ensures that there are low levels of fecal indicator bacteria in both the source water and the distribution system. Along with enteric viruses, the protozoan pathogens *Giardia* and *Cryptosporidium* are controlled by disinfection. Finally, drinking water cannot be a source of waterborne disease outbreaks.

- The Waterborne Disease Risk Assessment Program should determine whether the recent increase in protozoan parasitic infections observed via the disease surveillance system is from increased use of culture-independent diagnostic tests.
- Although the microbial monitoring program is well structured and meets all regulatory requirements, the data it collects could be better analyzed and used to inform the Watershed Protection Program.
- The Waterfowl Management Program has demonstrated effectiveness at reducing fecal coliform bacteria loads to reservoirs from waterbirds and other wildlife.

MONITORING, ASSESSMENT, AND MODELING

NYC DEP monitors a very large set of parameters within their watersheds, reservoirs, conveyances, and related facilities with real-time and near real-time sensor arrays as well as grab samples and laboratory analyses. Monitoring data related to water quality and streamflow, along with watershed and reservoir models, are used to varying degrees in evaluations of engineering, water supply operation and design, and program assessments. The most relevant example is the Operations Support Tool, a combined water quantity/water quality model that simulates water availability and quality throughout the NYC water supply system and is used to inform decisions about system operation and planning.

- Reporting on water quality should always include some formal statistical testing for trends.
- The NYC DEP is urged to shift its modeling and reporting of progress in the Watershed Protection Program evaluation to a mass balance approach.
- Watershed modeling should become a more integral part of the Watershed Protection Program.

- The Watershed Protection Program would benefit from additional and substantial monitoring and analyses of community vitality.

FINAL THOUGHTS

The 1997 MOA and Watershed Protection Program have largely succeeded in maintaining or enhancing water quality for the NYC water supply system and providing sustained investments to enhance the economic vitality of watershed communities.

Component programs within the Watershed Protection Program are generally well-balanced, with a few exceptions. The NYC DEP should reduce expenditures in the Land Acquisition Program to fund other programs that will lead to more direct improvements in water quality. Programs with greater incremental value include an improved Watershed Agricultural Program, an improved Septic System Program, and the Watershed Forestry Program. This reallocation of funds is based on the seemingly small incremental contributions of the Land Acquisition Program to drinking water quality and its negative effects on community vitality, compared with the likely improvements to water quality from additional resources provided to these other programs.

COMMITTEE TO REVIEW THE NEW YORK CITY WATERSHED PROTECTION PROGRAM

Paul K. Barten (*Chair*), University of Massachusetts, Amherst; **Dorothy J. Merritts** (*Vice-Chair*), Franklin and Marshall College; **Michael A. Anderson**, University of California, Riverside; **Elizabeth W. Boyer**, Pennsylvania State University; **Zachary M. Easton**, Virginia Tech; **Stephen A. Estes-Smargiassi**, Massachusetts Water Resources Authority; **Robert M. Hirsch**, U.S. Geological Survey; **Desmond F. Lawler**, University of Texas, Austin; **Menu B. Leddy**, Orange County Water District; **Jay R. Lund**, NAE, University of California, Davis; **Anita Milman**, University of Massachusetts, Amherst; **Catherine A. O'Connor**, Metropolitan Water Reclamation, Chicago, Illinois; **Soni M. Pradhanang**, University of Rhode Island; **Kenneth H. Reckhow**, Duke University; **John S. Schwartz**, University of Tennessee; **Christine E. Stauber**, Georgia State University; and **Richard C. Stedman**, Cornell University. Staff of the National Academies of Sciences, Engineering, and Medicine: **Laura J. Ehlers** (Study Director), **April Melvin** (Program Officer), **Eric J. Edkin** (Program Coordinator), **Brendan McGovern** (Research Assistant), **Raymond M. Chappetta**, (Research Assistant and Senior Program Assistant), and **Elleni Giorgis** (Program Assistant).

For More Information . . . This Consensus Study Report Highlights was prepared by the National Academies of Sciences, Engineering, and Medicine based on the Consensus Study Report *Review of the New York City Watershed Protection Program* (2020). The study was sponsored by the New York City Department of Environmental Protection. Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of any organization or agency that provided support for the project. Copies of the Consensus Study Report are available from the National Academies Press, (800) 624-6242; <http://www.nap.edu> or via the Water Science and Technology Board web page at <http://www.nationalacademies.org/wstb>.

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